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FOREST INSECT INVESTIGATIONS

THE PRESENT STATUS
OF THE
YELLOWSTONE BARK-BEETLE CONTROL PROJECT
1934

by
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INTRODUCTION

Control work in connection with the Yellowstone bark-beetle control project, which had as its objective the protection of aesthetic and commercial lodgepole pine forests from the ravages of the mountain pine beetle (Dendroctonus monticolse Hopk.), was discontinued following the 1931 spring operation. A report entitled "History of the Mountain Pine Beetle Infestation in the Lodgepole Pine Stands of Montana", which briefly depicts the history of this situation to the time of the 1934 surveys, was submitted to all interested agencies under date of July 28, 1934. The present report will present the results of these surveys, the entomological aspects of the existing situation, and the cost and advisability of control. Though desiring to keep this report as brief as possible, considerable detail has been employed in an effort to present all pertinent factors involved. In the desire for brevity it is possible that important items may have been omitted or their explanation slighted. If so, additional information will be given gladly. The purpose of this report is to present a summation of the data secured from surveys of the Beaverhead and Gallatin Forests in Region 1, the Targhee and Teton Forests in Region 2, and the Yellowstone and Teton National Parks. Though these surveys were financed by the respective

managing bureaus, the work was under the direct supervision of the Coeur d'Alene Laboratory of the Bureau of Entomology and Plant Quarantine. Mr. A. L. Gibson was in charge of the work on the Beaverhead and Gallatin Forests; Mr. E. E. Miller assumed responsibility for the Teton and Targhee; and Mr. T. T. Terrell directed the work in the Yellowstone Park.

LATE HISTORY OF PROJECT

Though the complete history was included in the preceding report, it seems advisable to review that portion of the history subsequent to the cessation of control in 1931. Though at that time further control seemed entomologically and economically unsound, this laboratory was instructed to keep the situation under observation, and if at any future time control appeared more feasible, it was to be again brought to the attention of proper authorities.

Following these instructions, a survey was made of the Yellowstone Park and adjacent National Forests in the fall of 1932, which depicted a situation that was not as discouraging as had been anticipated. An analysis of these data placed the project in a more favorable light than that of the previous season, as no irrecoverable loss had as yet followed the cessation of control. However, the infestation to the north--Beaverhead Forest and adjacent areas in the Madison Forest--continued to increase to alarming proportions, constituting a real menace to the success of control on adjacent areas. However, as funds had been made available for control on the Teton, Wyoming, and

Cache National Forests, it was believed that the institution of control on the Targhee, where a marked increase in the infestation had occurred, would be justified. This position was based upon the need for eliminating the rapidly developing centers of infestation, which would soon become--if they had not already--a source of reinfestation to adjacent forests where control was being conducted. This recommendation was made with the full realization that no assurance of success could be given, but it was believed that even a slight chance of success would justify the expenditure. Though funds were not available for the adoption of this plan, control measures were again conducted on the Wyoming and Cache.

During the winter of 1932-33 a distinct "break" occurred in the infestation in several portions of the general project. Extremely low temperatures in December 1932 and again in February 1933 were followed by a very high mortality of overwintering mountain pine beetle broods. This mortality varied for different areas, depending upon the range of these abnormal temperatures. With the encouragement of this "break" the forests of the Yellowstone project were again surveyed in the fall of 1933. An analysis of these data seemed to place the project in a still more favorable light. In the northern forests, where extremely low temperatures had occurred, a high mortality followed, which naturally reduced the potential danger of these areas as sources of infestation. Though sufficient timber still remained in these areas to permit the infestation to rebuild in severity, it could not possibly reach its former magnitude. Therefore, the serious potentials of the

situation seem to justify our taking full advantage of this "break", and the institution of control, involving the expenditure of several hundred thousand dollars, was recommended for the spring of 1934. Again funds were not available, and no control was instituted.

In the summer of 1934 the situation was again brought to the foreground with the idea of once more determining the existing status of the infestation in order to consider the advisability of reopening the project in 1935. To secure this information the surveys previously mentioned were instituted on a more intensive scale than ever before.

STATUS OF THE 1934 SITUATION

The data secured from the 1934 surveys are decidedly unpleasant to behold, as they reveal an infestation distributed throughout a tremendous acreage, with thousands of trees harboring broods of the mountain pine beetle. In fact, the project now assumes such a magnitude that the institution of control appears economically unsound. However, this report includes the necessary set-up for the proper institution of control in order that the magnitude of the situation can be better appreciated. The infested acreage and the number of trees are given in the following table:

STATUS OF THE MOUNTAIN PINE BEETLE INFESTATION ON THE FORESTS INCLUDED
IN THE YELLOWSTONE PARK CONTROL PROJECT--1931-1934

Forested Area	Acreage Surveyed in				Number of Infested Trees			
	1931	1932	1933	1934	1931	1932	1933	1934
Beaverhead	1,415,340	1,415,340	1,415,340	1,415,340	15,402,520	17,586,171	869,647	1,081,310
Sheep Canyon	23,680	23,680	23,680	23,680	23,183	151,000	14,858	18,447
Madison	45,780	431,230	479,380	986,530	6,975	40,210	43,525	668,449
Gallatin	728,150	728,150	728,150	728,150	23,147	40,728	32,159	117,267
Targhee	480,427	494,587	464,284	580,804	119,874	170,862	303,188	515,753
Teton	4,500	4,500	14,077	565,300	1,461	230	9,848	285,332
Grand Teton Park	--	--	6,000	6,000	283	281	1,575	3,359
Yellowstone Park	117,826	117,826	202,113	1,953,000	43,999	40,590	61,005	252,361

In comparing the 1934 situation with that of previous seasons it should be understood that differences in acreage and numbers of infested trees can not always be taken as a change in the status of the infestation. In fact, it is largely due to more intensive surveys, which included larger acreages. Therefore, though there have been some decided increases in the infestation, the data only depict the situation as known at the close of each survey. Had previous surveys been as intensive as the work in 1934, there would have been less difference in the data. Where acreage figures are the same for two years, a difference in the amount of infestation is obviously a change in the status of the epidemic.

BEAVERHEAD NATIONAL FOREST

Though in the set-up for the Yellowstone project no control would be conducted on this forest, it has been included, as during previous years the heavy infestation which it supported was considered as a potential source of supply to the southern areas upon which control was being conducted. The following table gives a statistical history of the infestation on this forest for the past four years:

STATUS OF THE MOUNTAIN PINE BEETLE INFESTATION ON THE BEAVERHEAD NATIONAL FOREST
1932-1934

Unit	: 1934	Number of Attacked Trees			Attacked Trees per Acre		
	: Acreage	: 1932	: 1933	: 1934	: 1932	: 1933	: 1934
Pintler	61,600	667,732	37,167	7,558	10.084	.603	.123
Mussigbrod	56,300	1,424,904	12,085	5,765	25.320	.215	.102
Battlefield	102,400	2,471,203	37,895	5,726	24.130	.370	.056
West Side	76,500	1,468,693	52,129	23,332	19.210	.681	.305
Jackson	75,800	1,730,767	51,279	14,569	22.836	.676	.192
Bloody Dick	108,160	2,796,036	55,603	31,193	25.853	.514	.288
Horse Prairie	57,000	93,525	32,092	29,577	1.641	.563	.519
Rattlesnake	68,400	513,334	63,915	183,011	7.504	.934	2.676
Grasshopper	42,500	574,034	12,455	45,058	13.520	.293	1.060
Warm Springs	54,500	1,736,678	42,241	51,284	31.881	.775	.941
East Side	86,200	660,867	13,403	14,324	7.666	.156	.166
Upper Wise River	142,800	1,466,162	150,316	243,945	8.167	1.053	1.708
Lower Wise River	59,000	893,323	133,578	87,694	15.134	2.264	1.486
Melrose	132,700	1,182,491	110,919	315,428	8.913	.836	2.377
Lima	218,000	206,422	64,570	22,846	.947	.296	.104
Totals and Averages	1,341,860	17,586,171	869,647	1,081,310	13.106	.648	.806

The infestation on this forest built from a few thousand trees in 1927 to a heavy infestation of 17,586,171 trees in 1932, dropped to 869,647 in 1933, but increased again in 1934 to 1,081,320. The abnormal drop in the infestation in 1933 followed the extreme brood mortality resulting from the low temperatures of the previous winter; however, the 1934 data indicate a recovery from this abnormal occurrence by showing a slight increase. Though such a recovery was expected, the infestation can not rebuild to its former severity because of the lack of host material. It is doubtful if the infestation can increase to an annual loss of more than three or four million trees. This so-called "break" in the infestation materially reduced the danger of this area as a source of reinfestation, but did not result in its elimination. Sufficient timber still remains in the eastern units (Melrose, Wise River,attlesnake, etc., where the infestation has only been present for a few years) to permit some heavy centers of infestation to develop, from which insect migrations are believed to occur.

SHEEP CANYON AREA

The Sheep Canyon area, which lies midway between the Beaverhead and old Madison Forests, though small in area, has been considered as a separate unit owing to its peculiar isolation. There are approximately 52,000 acres of public domain in the entire unit, with some 23,680 acres of lodgepole type, which in turn is separated from other bodies of pine by 15 or 20 miles of timberless prairies. The following table presents the data available for this unit:

STATUS OF THE MOUNTAIN PINE BEETLE INFESTATION IN THE
SHEEP CANYON HILLS (PUBLIC DOMAIN)
1932-1934

(1) Acreage of Area 23,680						
Number of Attacked Trees			::	Attacked Trees per Acre		
1932	:	1933	:	1934	::	1932 : 1933 : 1934
151,000		14,858		18,447		6.377 .627 .779

(1) Acreage of susceptible timber in area about 4,000, limited chiefly to high areas and less exposed slopes with unsuitable timber or open areas between.

Though some 23,680 acres were surveyed, the lodgepole was actually confined to approximately 4,000 acres, distributed in small areas throughout the surveyed territory.

An abnormal drop in the infestation similar to that which occurred on the Beaverhead is shown for this area. Though the 1934 data indicate a slight increase over those of 1933, the infestation can not possibly rebuild to its former position, due to the shortage of host material. Furthermore, it is doubtful whether it can rebuild to a magnitude sufficient to constitute a dangerous source of infestation to other areas. Though a very large percent of the timber within this area will be destroyed, its value does not justify any expenditure for control.

MADISON NATIONAL FOREST

In 1932 the old Madison Forest was discontinued as an administrative unit, and the area divided between the Gallatin, Beaverhead, and Deerlodge National Forests. In this report, however, the old set-up of forests has been maintained, as shown on the accompanying map, in order to facilitate the presentation of the existing situation. The old Madison, which bordered the Yellowstone and Targhee Forests, was separated from the Beaverhead by a rather wide, timberless area. At the time control was discontinued in the Big Hole Basin (Beaverhead), it was hoped that these timberless areas would at least act as a partial barrier to the further spread of the severe Beaverhead infestation. However, they did not, as was shown in the July 1934 historical report.

The following table presents the data available for this area:

STATUS OF MOUNTAIN PINE BEETLE INFESTATION ON MADISON NATIONAL FOREST
1932-1934

Unit and Map Number	: 1934 ::		Number of Attacked Trees			::		Attacked Trees per Acre		
	: Acreage ::		1932	: 1933	: 1934	::		1932	: 1933	: 1934
Cabin Creek	9	86,800	7,066	9,523	8,940		.081	.110	.103	
West Yellowstone	10	79,850	3,476	1,170	4,472		.043	.015	.056	
Indian-Wolf Cr.	11	91,600	7,447	9,148	9,893		.081	.100	.108	
Jack Creek	12	75,500	Unsurveyed	Unsurveyed	42,225		Unsurveyed	Unsurveyed	.559	
Crockett Lake	13	124,150	"	"	80,080		"	"	.645	
Horse Creek	14	48,150	"	0	9,293		"	.000	.193	
West Fork Madison River	15	127,200	2,904	16,180	7,378		.023	.127	.058	
Ruby River	16	121,900	Unsurveyed	Unsurveyed	95,975		Unsurveyed	Unsurveyed	.787	
Blacktail Hills	17	45,780	19,317	7,504	37,713		.422	.164	.824	
Tobacco	18									
Root Mts.	to 20	185,600	Unsurveyed	Unsurveyed	372,480		Unsurveyed	Unsurveyed	2.007	

In some of the units of this forest there was some indication of abnormal brood mortality produced by low temperatures, though it was not very marked. The Tobacco Root Mountains, Jack Creek, Crockett Lake, and Ruby River units of the old Madison were surveyed for the first time this year. This action was considered necessary, as the existing infestation was rapidly building to an intensity where it would become a potential source of insect dissemination with a distinct relationship to any thoughts of control within adjacent areas. It will be noted that there are 372,480 infested trees in the Tobacco Root Mountains, which are concentrated in some extremely heavy blocks of infestation. This infestation will possibly show an increase for the next two years, after which there will be a marked reduction in the annual loss, due to the lack of sufficient host material to carry such an infestation. Regardless of this fact, the infestation on the Old Madison will continue to constitute a potential source of bark-beetle dispersal for some few years.

GALLATIN NATIONAL FOREST

The infestation on this forest dropped slightly following the brood mortality produced by the low temperatures of the 1932-33 winter. However, recovery followed in 1934 with an increase of 266 percent. The 1934 infestation is in both lodgepole and whitebark pine, approximately 30% being confined to lodgepole. Though this infestation is not very severe at this time, it is apparently building to an epidemic status, with a few severe "hot-spots" existing at this time. The following table shows the data available for this forest:

STATUS OF THE MOUNTAIN PINE BEETLE INFESTATION ON THE GALLATIN NATIONAL FOREST
1932-1934

Unit and		: 1934	::	Number of Attacked Trees			::	Attacked Trees per Acre						
Map Number		: Acreage	::	1932	:	1933	:	1934	::	1932	:	1933	:	1934
Mystic Lake	1	150,700		3,128		6,688		5,985		.021		.044		.040
Miner Creek	2	71,700		12,560		7,470		37,000		.175		.104		.516
Porcupine Creek	3	66,250		2,344		1,691		1,736		.035		.026		.026
Swan-Squaw Creek	4	57,000		3,580		1,864		10,136		.063		.032		.178
South Cottonwood Cr.	5	71,100		0		1,868		1,379		.000		.026		.019
Gallatin Fk	6	88,700		5,594		3,375		16,253		.063		.038		.183
West Gallatin River	7	104,200		3,950		3,334		3,543		.038		.032		.034
Taylor Fork	8	118,500		9,572		5,869		9,076		.081		.049		.076
Monument Creek	8a	14,700		Portion of Unit #8				3,150		--		--		.214

TARGHEE NATIONAL FOREST

Control measures were instituted on this forest in 1928 on a very small acreage. The project was continued during the three subsequent years on an increasing acreage until in 1931 there were 102,870 acres covered by control. This increase in acreage was not entirely due to the spread of the infestation into other uninfested areas, but primarily to the fact that the entire area had not been adequately surveyed. This policy permitted new infestation to escape attention until such time as the outbreak became so severe as to attract attention. An adequate survey in the fall of 1931 revealed that an infestation existed throughout the entire northern portion of the forest. Approximately 480,427 acres were covered by this survey, of which 102,870 acres had been covered by control during the spring of 1931. Though the known infested acreage was increased by 370%, the number of infested trees per acre was but 70% of the number for the previous season. This was as expected, as the infested trees (35,987) on the smaller acreage had been treated, and the 1931 survey disclosed many areas with relatively new infestations. No control measures have been conducted since 1931, and the infestation has steadily increased until at this time a serious condition exists, which is depicted in the following table. Though a large percent of the timber in this forest has already been destroyed, there are large bodies still remaining, which are sufficient to carry the present epidemic for a number of years and which will constitute a serious menace to all adjacent bodies of timber.

STATUS OF THE MOUNTAIN PINE BEETLE INFESTATION ON THE TARGHEE NATIONAL FOREST
1932-1934

Unit	1934	Number of Attacked Trees			Attacked Trees per Acre		
	Acreage	1932	1933	1934	1932	1933	1934
1	27,660	18,006	21,270	20,939	.651	.769	.757
2	61,700	35,169	58,923	93,846	.570	.955	1.521
3	43,520	12,795	25,894	65,715	.294	.595	1.510
4	28,280	12,980	36,905	35,802	.459	1.305	1.266
5	48,710	38,822	70,435	128,789	.797	1.446	2.644
5a	15,000	810	2,610	2,100	.054	.174	.140
6	16,360	720	10,258	17,832	.044	.627	1.090
7	93,400	4,670	14,103	24,751	.050	.151	.265
8	27,520	2,477	5,917	28,125	.090	.215	1.022
9	17,600	3,872	2,781	2,570	.220	.158	.146
10	12,360	2,101	3,757	10,308	.170	.304	.834
11	8,940	2,593	1,395	8,690	.290	.156	.972
12	3,200	352	1,600	3,894	.110	.500	1.217
13	4,800	331	3,370	4,368	.069	.702	.910
14	16,600	963	3,519	5,594	.058	.212	.337
15	10,275	3,699	6,257	7,727	.360	.609	.752
16	19,295	23,270	26,396	14,606	1.206	1.368	.757
17	44,500	11,793	14,151	29,993	.265	.318	.674
18	14,578	1,618	4,417	3,732	.111	.303	.256
19	7,570	1,211	757	1,726	.160	.100	.228
20	6,936	3,329	4,016	2,046	.480	.579	.295
21	52,000	--	--	2,600	--	--	.050
Tot. & Av.	580,804	181,581	318,731	515,753	.343	.603	.868

TETON NATIONAL FOREST

The 1934 survey was the first complete insect reconnaissance made of this forest. It will be seen that in 1933 there were 15,000 infested acres reported, while this season's survey covered 565,300 acres, which carried an average infestation of .505 trees per acre. This infestation is distributed throughout the entire forest in both lodgepole and whitebark pine stands, with many so-called "hot spots" of a real epidemic nature. Needless to say, the infestation within this forest is of a serious nature, and must be considered as a source of danger to all immediate and adjacent timber stands.

STATUS OF THE MOUNTAIN PINE BEETLE INFESTATION ON THE TETON NATIONAL FOREST 1934

	:	Number of Attacked Trees			:	Attacked Trees per Acre		
Unit	: Acreage	: LPP	: WBP	: Total	:	LPP	: WBP	: Total
1	98,000	15,778	9,898	25,676	:	.161	.101	.262
2	80,200	32,561	115,247	147,808	:	.406	1.437	1.843
3	59,100	8,215	19,207	27,422	:	.139	.325	.464
4	36,100	866	325	1,191	:	.024	.009	.033
5	14,400	1,094	3,715	4,809	:	.076	.258	.334
6	69,100	--	1,382	1,382	:	--	.020	.020
7	18,100	--	--	--	:	--	.000	.000
8	13,800	745	3,008	3,753	:	.054	.218	.272
9	18,700	--	187	187	:	--	.010	.010
10	61,000	7,747	3,233	10,980	:	.127	.053	.180
11	40,000	7,880	--	7,880	:	.197	.000	.197
12 (Est.)	56,800	17,324	36,920	54,244	:	.305	.650	.955
Totals	565,300	92,210	193,122	285,332	:			

YELLOWSTONE NATIONAL PARK

Though the Yellowstone Park has been covered by a survey for the past three years, the work has not been as complete as the 1934 operation. This season's survey, which included a very large portion of the park, revealed an infestation distributed throughout the surveyed area, which, as previously stated, is primarily confined to the whitebark pine stands at high elevations. Though insects are present in lodgepole pine, there are no serious situations as yet, and it is impossible to accurately predict just what will occur. However, a serious infestation exists in all the whitebark pine stands, which as far as is known constitutes a serious menace to adjacent lodgepole pine stands.

THE MOUNTAIN PINE BEETLE INFESTATIONS IN THE LODGEPOLE AND WHITEBARK PINE STANDS OF YELLOWSTONE NATIONAL PARK 1934

Unit Area	: Acres of :		: Total	: Acres of :		: Total	: Total
	: WBP	: N.A.	: Infested	: LPP	: N.A.	: Infested	: Infestation
	: Type	: Per Acre	: WBP	: Type	: Per Acre	: LPP	: on Unit
Northwest Corner	84,000	.463	38,892	265,000	.115	30,475	69,367
Washburn	22,000	.201	4,422	153,000	.029	4,437	8,859
Northeast Corner	139,000	.165	23,000	350,000	.014	4,900	27,900
Central)	Estimated, not surveyed			200,000	.009	1,800	1,800
Madison Plateau)				200,000	.030	6,000	6,000
Bechler-Pitchstone	26,000	.375	9,750	200,000	.374	74,940	84,690
Southeast Corner	103,000	.458	47,204	211,000	.031	6,541	53,745
Total	374,000	.329	123,268	1,579,000	.082-	129,093	252,361

TETON NATIONAL PARK

There is a relatively small timber acreage in this park, which a few years ago was set aside from the Teton National Forest. In 1931 a light infestation, which was promptly treated, was recorded from Jenny's Lake. Infestations also existed in high, nearly inaccessible whitebark pine stands, though no control was instituted until three of these areas were made accessible by newly constructed trails. Though previous surveys had recorded no infestation, the start of an outbreak was recorded in the southern portion of the park (Windy Point Area) in the fall of 1933. The 1934 survey showed an increase in acreage and severity in this outbreak, which has started to assume rather serious proportions. In the infested acreage there are a few "hot spots", with the infestation averaging over 3 trees per acre.

THE MOUNTAIN PINE BEETLE INFESTATION IN LODGEPOLE PINE ON THE TETON NATIONAL PARK

Area	:	Infested Trees			Trees per Acre		
		:: Acres	:: 1932	: 1933 : 1934	:: 1932	: 1933 : 1934	
Lakes Area	:	1,950	0	276 298	--	.142 .153	
Beaver Cr Area	:	300	0	? 945		? 3.152	
Windy Point	:	3,600	0	1,260 1,573	0	.35 .437	
Phelps Lake	:	150	0	? 543		? 3.62	
	:	6,000		3,359			

In addition to the infestation shown in the above table, there is the infestation in the whitebark pine along the higher elevations, from which the outbreak in lodgepole is assumed to have originated. As the whitebark pine stands were practically inaccessible insofar as an insect survey is concerned, no effort was made to include such areas in this season's survey.

THE 1934 SITUATION

As this situation is reviewed, the tremendous acreages involved as well as the physical difficulties of instituting control in the short period of time available for such work immediately impress one with the magnitude of the task. In addition to such physical difficulties there are entomological angles which must receive proper consideration. Long-distance flights of beetles; the ability of an infestation to spread from one unit of forest to another; host selection, or the danger which infestations in whitebark pine constitute to adjacent lodgepole pine stands; and the potential increase of light infestations, which determines the intensity of infestation which should be treated, are entomological questions firmly interwoven into this project. In explanation of their relation to the proper solution of this problem, a rather detailed discussion follows.

The ability of the mountain pine beetle to fly or be carried long distances by favorable air currents is a mooted question. Situations have occurred and are still occurring which forest entomologists can only explain by such disseminations. Though it is true that no positive proof can be offered, it is fully realized that flights are not impossible, and in explanation of such situations no other logical answer can be given. It is not believed that tremendous swarms of these beetles move periodically from one area to another, attacking thousands of trees in territories which previously were free from insects. On the contrary, such migrations, or dispersals, are believed to result from small numbers of beetles moving into areas which were

either free from bark beetles or where only a normal infestation existed. These few beetles may attack scattered trees throughout the area, or they may merge with those already present. As a result of this introduction, vigorous, heavy broods are produced, creating an increasing infestation which in a few years develops to epidemic proportions. Additional introductions of beetles may occur during subsequent years, which help to increase the severity of the infestation already established. The presence of dead trees which have been killed for three or four years prior to the time the outbreak is discovered is often offered as proof against long-distance insect migration. On the contrary, such trees are but natural steps in the building of an epidemic, which could have received its inception from a flight of beetles some few years before. In advancing this position there is no intention of saying that epidemics do not develop locally. However, it will be seen that long-distance flights, or dispersal, of bark beetles from heavy centers of infestation seriously threaten the success of control on adjacent areas.

The fact that epidemic infestations of the mountain pine beetle spread from one drainage unit or forest into other areas adjacent has been clearly established. The present Montana outbreak has been followed as it swept from one drainage to another, in such a manner as to expell any possible doubt as to such occurrence. This knowledge clearly demonstrates the unsoundness of confining control work to restricted areas such as sections or other imaginary boundary lines.

Host selection, or the preference of an insect for one species of host plant over all others, is an important issue in the Yellowstone Park control problem. The mountain pine beetle attacks both whitebark pine and lodgepole pine along with other species of pine. Whitebark pine occurs at high elevations along the tops of divides, and though this timber has but little commercial or scenic value, it does support severe beetle infestations. As these stands are distributed throughout the entire area included in this project, and adjacent to - in fact, often intermingled at lower elevations with - lodgepole pine, the relationship which the insects in this low-valued timber species bear to the lodgepole stands for which protection is desired becomes of vital importance. Will these high, rather inaccessible areas of whitebark pine need be included in a plan of control which may be formulated for this project? The writer fears that if success is to follow the institution of control, and at least semi-permanency of results secured, the answer must of a necessity be "Yes". Though rather evident that whitebark pine is preferred as a host over lodgepole, the beetles emerging from whitebark pine will attack lodgepole when a shortage of the preferred host occurs. No positive proof can be offered in support of this contention, though there would seem to be ample evidence to clearly establish the danger of such an occurrence.

Areas which support a light, scattered infestation constitute another serious problem in planning and directing control. Where the infestation averages only one or two tenths of a tree per acre, control

operations are much more expensive than in heavily infested units. However, light infestation may be the start of serious outbreaks, and if left untreated soon show a marked increase in timber losses and become centers of infestation, which menace adjacent controlled areas. If, on the other hand, the situation is but a normal condition, the institution of control would be not only expensive but useless. The character of the infestation is a better guide than the number of infested trees per acre.

As the existing situation unfolds, the seriousness and difficulty of solving this problem are appreciated. Were one able to foresee the devastation which will occur if no control is instituted, then the advisability of instituting this project could be more easily determined. Unfortunately, such predictions are almost impossible to make, so a decision as to the advisability of instituting control must rest upon the devastation which has occurred in other areas.

As the advent of natural control can not be foreseen, it must be assumed that the existing infestation will continue in its present status until it has swept through the forests in question. In weighing the timber values at stake, those of both a commercial and scenic nature must be considered. Scenic timber values are difficult to appraise, though they often outweigh those of commercial forests.

The Targhee Forest is stocked with fine commercial lodgepole pine stands, which are in demand for railroad ties, poles, etc. An infestation exists within these stands which, unless checked, will

in the next three or four years destroy a large percent of the mature trees which still remain. On the Gallatin, Teton, and Wyoming Forests accessible commercial stands of lodgepole are also infested, though at this time not as heavily as those on the Targhee.

In the Yellowstone Park the infestation is largely confined to whitebark pine at higher elevations. Though some infestation is present in the lodgepole pine stands, it is not of a serious nature at this time, with the exception of the southwest corner, where a rather bad situation exists. The destruction of the whitebark pine would be of no great import, as it would only affect the scenic values of the Dunraven and Sylvan Pass areas. However, as some of the park camp grounds and lodges depend to a certain extent upon lodgepole pine for the attractiveness of their setting, a devastating epidemic would seriously mar their attractiveness. Though no data are available upon which to base such an opinion, it is possible that environmental factors exist in this area which are unfavorable for such outbreaks as have occurred at lower elevations.

In the Grand Teton Park a more threatening situation exists. An infestation which apparently originated from the whitebark pine areas shows indications of increasing to a point where scenic timber stands will be badly ^pdeleted.

To await favorable intervention by nature for the reduction of this outbreak is a gamble, with heavy odds against its occurrence. On the other hand, it is obvious that the institution of artificial control would be a tremendous operation involving large appropriations, with perhaps equally as large a gamble as to the ultimate success of the venture.

Artificial control can be administered so as to successfully reduce an outbreak on a given territory if reinfestation does not occur from untreated areas adjacent or there is no influx of beetles from remote centers of infestation. If all infested trees within the different units of the Yellowstone project could be located and treated, and no reinfestation from outside areas occurred, success would follow the first year's operation. Though such results are often secured on small, isolated areas of infestation, such a clean-up would be nearly impossible to secure with a project of this size. Therefore, even if it were possible to eliminate the danger of reinfestation, at least two years maintenance control would be necessary to insure success.

Timber killed during epidemics of the mountain pine beetle is a serious fire hazard. Insect-killed lodgepole pine trees start falling in ten or twelve years, creating a tangled mass of inflammable material which, when ignited, results in conflagrations which completely destroy all remaining vegetation. If areas of insect-killed lodgepole are spared this subsequent devastation, there are usually sufficient green trees which have escaped the beetle attack to provide a fairly

green cover for the areas after the dead trees have fallen. In many areas which have been swept by outbreaks some fifteen or twenty years ago, it is difficult to tell that such a devastation has occurred unless one enters the forest where the down trees remain for several decades.

An attempt has been made to present both sides of this problem as fairly as possible, though it is regretted that a more positive position could not be taken. All interested agencies are familiar with the devastation that has been left in the wake of this outbreak. In weighing the advisability of recommending the institution of control for this project, both the physical difficulties and, in addition, the money required must be balanced against the potential devastation.

AREAS FOR WHICH CONTROL WILL BE REQUIRED
AND COST OF THE OPERATION IN THE EVENT CONTROL
IS INSTITUTED

In considering the institution of control for the protection of the scenic and commercial timber value at stake, there will be a difference of opinion as to the areas which should be included. To insure any degree of permanency in the results secured it would seem very essential that control be instituted on all contiguous areas where there is an infestation which will eventually spread into and destroy the benefits secured from control on adjacent units. The set-up of areas for which control will be deemed necessary includes units from the Madison, Gallatin, Targhee, and Teton Forests, and the Yellowstone and Grand Teton National Parks. Though believing in the possibility of long-distance dissemination of insects, this set-up has been based entirely upon the danger of the infestation spreading from one area to another, with no consideration of the former possibility. Obviously, if the maximum potential spread of the mountain pine beetle is to be considered in formulating this project, there are areas on the Beaverhead (Malrose, Wise River, Rattlesnake units) and Madison (Tobacco Root Mountains) where serious outbreaks exist at this time which would surely be considered as dangerous centers of beetle dissemination. Furthermore, in designating the need for control on smaller areas there are border-line cases where the decision is difficult to make. It is necessary to base such decisions upon the intensity of the infestation, which is secured from a very extensive survey, which in some cases was not

very elaborate. However, all such instances have been carefully studied, and the decision made after careful consideration of all factors.

The following table shows the areas for which control will be considered necessary if the so-called Yellowstone Park bark-beetle control project, which has as its objective the protection of the scenic values of National Parks as well as commercial timber stands within the adjacent National Forests, is reopened:

Madison National Forest									
Whitebark Pine					Lodgepole Pine				
: No. and total cost : Trees : No. and total cost : Trees :					: Trees :				
: of control camps : to be : of control camps : to be :					: to be : Cost in-				
Unit and Map Number : at \$11,189.83 ea. : treated :					at \$10,097.50 ea. : treated : Fuel Oil : treated : cluding oil				
	No.	Cost			No.	Cost			
Jack Creek	12	--	--	--	12	\$ 120,090.00	32,225	\$ 2,175.19	32,225 \$ 122,265.19
Crockett Lake	13	--	--	--	25	250,187.50	80,080	5,405.40	80,080 255,592.90
Horae Creek	14	--	--	--	4	40,030.00	9,293	627.28	9,293 40,657.28
Ruby River	16	--	--	--	30	300,225.00	95,975	6,478.31	95,975 306,703.31
Blacktail Hills	17	--	--	--	5	50,037.50	37,713	2,545.63	37,713 52,583.13
Total	--	--	--	--	76	760,570.00	255,286	17,231.81	255,286 777,801.81

Gallatin National Forest									
Miner Cr.	2	8	\$ 89,518.64	37,000	--	--	--	--	37,000 89,518.64
Svan-Squaw Cr.	4	4	44,759.32	9,590	--	--	--	--	9,590 44,759.32
Gallatin Peak	6	--	--	--	7	70,052.50	21,000	1,417.50	21,000 71,470.00
Monument Cr.	8(a)	2	22,379.66	3,150	--	--	--	--	3,150 22,379.66
Total	14	14	156,657.62	49,740	7	70,052.50	21,000	1,417.50	70,740 228,127.62

Targhee National Forest									
1-2-3	--	--	--	--	55	550,412.50	180,500	12,183.75	180,500 562,596.25
15-16-17-18-19-20	--	--	--	--	22	220,165.00	59,830	4,038.53	59,830 224,203.53
7-8-9-10-11-12-13-14	--	--	--	--	33	330,247.50	88,300	5,960.25	88,300 336,207.75
4-5-5A-6	--	--	--	--	37	379,277.50	184,523	12,455.30	184,523 382,732.80
Total	--	--	--	--	147	1,471,102.50	513,153	34,637.83	513,153 1,505,740.33

Teton National Forest									
1	4	44,759.32	9,107	4	40,030.00	11,970	807.98	21,077	85,597.30
2	36	402,833.88	139,251	3	30,022.50	4,857	327.85	144,108	433,184.23
3A	10	111,898.30	22,545	--	--	--	--	22,545	111,898.30
8	2	22,379.66	3,464	--	--	--	--	3,464	22,379.66
10	2	22,379.66	3,250	6	60,045.00	7,750	523.12	11,000	82,947.78
12	5	55,949.15	16,250	15	150,112.50	37,550	2,534.62	53,800	208,596.27
Total	59	660,199.97	193,867	28	280,210.00	62,127	4,193.57	255,994	944,603.54

Yellowstone National Park									
1	17	190,227.11	38,892	11	110,082.50	28,644	1,933.47	67,536	302,243.08
2	3	33,569.49	4,422	--	--	--	--	4,422	33,569.49
3	11	123,088.13	20,000	--	--	--	--	20,000	123,088.13
6	5	55,949.15	9,750	25	250,187.50	74,940	5,058.45	84,690	311,195.10
7	13	145,467.79	38,583	--	--	--	--	38,583	145,467.79
Total	49	548,301.67	111,647	36	360,270.00	103,584	6,991.92	215,231	915,563.59

Grand Teton National Park									
Entire Park	1	11,189.83	1,000	1	10,097.50	3,000	202.50	4,000	21,399.83

GRAND TOTAL OF COSTS BY FORESTS

Madison	--	--	--	76	760,570.00	255,286	17,231.81	255,286	777,801.81
Gallatin	14	156,657.62	49,740	7	70,052.50	21,000	1,417.50	70,740	228,127.62
Targhee	--	--	--	147	1,471,102.50	513,153	34,637.83	513,153	1,505,740.33
Teton	59	660,199.97	193,867	28	280,210.00	62,127	4,193.57	255,994	944,603.54
Yellowstone Park	49	548,301.67	111,647	36	360,270.00	103,584	6,991.92	215,231	915,563.59
Grand Teton Park	1	11,189.83	1,000	1	10,097.50	3,000	202.50	4,000	21,399.83
Grand Total	123	\$1,376,349.09	356,254	295	\$2,952,212.50	958,150	\$64,675.13	1,314,404	\$4,393,236.72

The number of infested trees to be treated as well as the acreage to be included in this project rather clearly describe the magnitude of the operation. The success of such an undertaking will depend very largely upon the ability to complete the prescribed work in the short time available. To accomplish this objective it will not only require large sums of money but also an organization of a size that will be extremely difficult to secure. Though the execution of control work can not be called a scientific task, it does require intelligent woodsmen, and the task of securing the required number of trained men to perform properly the various duties of such an operation, though not impossible, presents a difficult problem.

The following very rough plan of operation has been prepared in order to present a clearer picture as to the size of the organization as well as the funds which will be required to conduct this project. It is fully realized that the cost data as given can not be considered as final or complete. Errors in judgment have no doubt occurred even though an effort has been made to determine accurately the cost of all major items, and such errors would no doubt be noticed in any final plans of operations which may be drawn.

In considering the equipment which will be required for an operation of this magnitude, it is believed advisable to plan for the purchase of all materials. Possibly some old equipment could be provided from local warehouses, but it is believed that this amount would be so small as to be almost negligible. Furthermore, it is obvious that sufficient experienced men vitally essential to the

success of the project can not be secured to fill such key positions as Unit Managers, Work Foremen, Chief Spotters, and Checkers. To overcome this difficulty it will be necessary to plan for training camps, which of course will entail considerable expense, though some production will be secured from them. The responsibility of training spotters, compassmen, straw bosses, and treaters will of course be passed to the Chief Spotters and Work Foremen after they have been passed through the training period.

The prices of different items of equipment have been taken from present-day lists, which are of course subject to change. Subsistence, which includes kitchen labor, is cared for by deductions from wages. For the want of a better criterion for wages, the MIRA wage scale now in effect throughout this region has been applied, with new positions being created wherever they are believed necessary. The set-up for project "Headquarters" of each forest will include such personnel as the Unit Manager, Purchasing and Fiscal Agents, Truck Drivers, Clerks, etc. At the end of auto transportation it will be necessary to establish a base camp for serving control camps by pack trains. The cost of the equipment required for these camps as well as the cost of the necessary labor have been prorated to the cost of the individual control camps.

The cost of the operation has been based upon the expense of purchasing, establishing, and operating a control camp for the period of the project. This figure was secured by determining the cost of the necessary equipment, labor, transportation, supervision, etc.,

which was reduced to a direct charge against each camp. With this method it was necessary to establish a potential working period, which has been set at forty effective days for lodgepole pine and fifty effective days for whitebark pine. This difference is explained by the fact that there is a longer working period in whitebark pine than in lodgepole, due to the delayed emergence of the beetles at high elevations. With these data the total cost of control for each unit can be determined by securing the number of camps which will be required.

There is also a difference in the daily cost of whitebark pine camps and those in lodgepole, due to the difference in the method of control which will be used. In whitebark pine the spotting and marking of infested trees for treatment and the actual treatment will be conducted in two separate operations. Treating will consist of felling infested trees and skidding the logs into decks for subsequent burning. In lodgepole pine camps, spotting and treating will be conducted in one operation. Each spotting crew will be followed by a pack horse carrying oil, spray pump, and felling tools, and the infested trees will be treated as they are encountered.

The following tabulation shows the cost of purchasing, establishing, supervising, maintaining, and operating control camps. As stated, the cost is based upon forty effective working days for lodgepole and fifty effective working days for whitebark pine. To secure this number of effective days it will be necessary to operate the lodgepole pine camps for a period of sixty days, and the whitebark pine camps for seventy-four days. It will also be necessary to have such personnel as Forest Administrators, Unit Managers, Purchasing Agents, Clerks, and Warehouse Men on the project for a total period of at least three months.

COST OF OPERATING ONE CAMP
FOR THE DURATION OF THE PROJECT

	WBP Camps	LFP Camps
<u>Flat Charge Against all Camps</u>	<u>Total</u>	<u>Total</u>
1. Camp equipment	\$1,040.93	\$1,040.93
2. Tools	148.78	146.82
3. Mapping equipment	68.93	80.68
4. Fuel oil	--	(6.75¢ per tree)
5. Training period	267.19	267.19
6. Installing & moving camp	350.00	250.00
7. Base camp equipment	104.41	104.41
8. Transportation and operation	116.97	116.97
(a) <u>Equipment and operation</u>		
Fixed cost per camp	2,097.21	2,007.00 + oil
<u>Variable costs per camp</u>	<u>Days paid</u>	<u>Days paid</u>
(b) Pack stock at \$5.63 per day	74 416.62	60 337.80
(c) Labor " 5.91 " "	60 354.60	50 295.50
9. Labor - WBP \$159.92 - LFP \$167.92	50 7,996.00	40 6,716.80
10. Work stock - WBP @ \$2.50 per day		
LFP @ \$11.25 per day	50 125.00	40 450.00
11. General overhead at \$3.34 per day	60 200.40	60 200.40

Total cost of camp for period operated, \$11,189.83. \$10,007.50 + oil.
Cost of lodgepole pine camps does not include fuel oil for treating.

EXPLANATION OF ITEMS LISTED IN ABOVE TABULATION

- #1. Camp equipment - Includes all equipment necessary in the proper establishment and maintenance of a 32-man control camp. This set-up of equipment is the standard 32-man camp of Forest Service Region 1:

	WBP Camps	LFP Camps
Sleeping bags, sheet blankets, cots, mattress pads	\$413.32	\$ 413.32
Mess outfit, extra dishes, lunch bags, etc.	73.60	73.60
Kimmel fire boxes for tents, pipe, cook stoves, etc.	73.67	73.67
Tents, 8-14x16, 1-10x12, 2-14x16 flies, etc.	395.89	395.89
Communication. Radio, assembled kit	46.10	46.10
Miscellaneous equipment - Hammer, handsaw, nails, files, lights, candles, medicine kit, waterbags, cobbler's outfit	38.35	38.35
	<u>\$1,040.93</u>	<u>\$1,040.93</u>

#2. - Tools

	Whitebark Pine Camps	Lodgepole Camps
Axes, DE. 3 $\frac{1}{2}$	16 - \$32.00	8 - \$16.00
Axes, belt (Spotters)	12 - 10.20	24 - 20.40
Cant hooks	14 - 25.20	3 - 5.40
Saw, CC, 5 $\frac{1}{2}$ foot	10 - 40.40	5 - 20.20
Wedges, falling	18 - 3.78	8 - 1.68
Hammers, 4#, Single Jacks	8 - 4.80	4 - 2.40
Saw-filing outfit	1 - 2.80	1 - 2.80
Shovels, L.H.R.F.	5 - 5.00	5 - 5.00
Mattocks	4 - 2.40	4 - 2.40
Saw handles	5 pr. - 1.80	4 pr. - 1.44
Grindstone, mounted	1 - 8.50	1 - 8.50
Axe stones	12 - 1.20	6 - .60
Skidding tongs	2 - 4.00	--
Skidding chain	2 - 6.70	--
Spray tanks	--	12 - 48.00
Oil containers	--	12 - 12.00
	Total 148.78	146.82

#3. - Mapping equipment

Compasses, box, hand	4 - \$11.80	2 - \$ 5.90
Compasses, staff	2 40.00	3 - 60.00
Tatum holders, #4	2 1.64	3 - 2.46
Tally registers	3 5.49	4 - 7.32
Miscellaneous - Tags, crayon, stationary, etc.	10.00	5.00
	Total \$68.93	\$80.68

#4. - Fuel oil - The cost of fuel oil for the treatment of lodgepole pine will vary for different camp sites, being dependent upon the number of trees to be treated. Approximately three fourths of a gallon of oil is used for each tree, which will cost about 9 cents per gallon.

#5. - Training period - It has been estimated that all men holding key positions, such as Chief Spotters, Work Foremen, Checkers, and Unit Managers, should spend one week in training. This week would include their travel time to and from the camp. Of this

week it has been estimated that 60% of the time would be noneffective, which would result in an actual charge for training of \$267.19 for both whitebark pine and lodgepole pine camps.

#6. - Installing and moving camp - It has been difficult to arrive at a satisfactory figure for the installation and moving of camps. From the best data available applied to the terrain to be covered, a flat rate of \$350.00 for whitebark pine and \$250.00 for lodgepole pine has been established. Though this figure may show considerable variations for different units, it is believed to be a very fair average.

#7. - Base camp equipment - As each base camp can serve six control camps, the cost of equipment has been prorated, making a direct charge against each camp of \$104.41. This equipment includes:

Cook tent	14x16	- 1 -	\$ 42.25
Office tent	10x12	- 1 -	16.45
Sleeping tent	14x16	- 3 -	126.75
Storage tent	16x16	- 2 -	100.00
Cook outfit		1 -	17.00
Heating stoves		6 -	11.10
Cook stove		1 -	10.25
Beds, complete		18 -	232.20
Radio set		1 -	46.10
Tools, misc. items		-	24.34
			<u>\$626.44</u>

#8. - Transportation and operation - Difficulty was experienced in establishing a prorated control camp charge for transportation, owing to the variation in the different units. The plan adopted was to determine the cost of transportation for an administrative unit of 25-35 camps. This charge, which includes labor, rent of warehouse, operation and maintenance of equipment, etc.,

was then charged back as a direct camp cost.

8(a) Equipment prorated against each control camp:

Trucks)	
Warehouse rent)	\$116.97
Operation of trucks)		

8(b) Pack stock - It is estimated that each control camp will require the service of one half a full pack string of 9 head. Pack stock can be secured for \$0.75 per head per day, and can be fed for \$0.50. This gives a total for each string of \$11.25, or a charge against each camp of \$5.63 per day. As pack stock is usually hired on a thirty-day basis, it is necessary to compute its time on the total elapsed period of the project. Therefore, the charge against each whitebark pine camp is based on 7⁴ days and on 60 days for each lodgepole pine camp.

8(c) Labor - The labor charges in connection with transportation includes packers, truck drivers, and clerks, the cost of which is estimated at \$5.91 per day for each camp.

#9. - General Labor - The wages of all labor are based upon the present NIRA wage scale under which such projects are operating at this time. As previously stated, a few new positions have been set up when no wage scale was quoted for the position in question. The NIRA wage scale is a great deal higher than has been paid on previous control projects, and of course has raised the total cost proportionately.

	Day Wage	Whitebark Pine Camps	Lodgepole Pine Camps
Work Foreman	\$10.80	1 - \$ 10.80	1 - \$ 10.80
Cook	9.60	1 - --	1 - --
Second Cook	6.40	1 - --	1 - --
Flunkey	4.00	1 - --	1 - --
Bull Cook	4.80	1 - 4.80	1 - 4.80
Chief Spotter	6.80	2 - 13.60	3 - 20.40
Compassman	5.20	2 - 10.40	3 - 15.60
Checker	8.32	1 - 8.32	1 - 8.32
Straw boss	6.40	2 - 12.80	0 - 0.00
Spotters	5.20	8 - 41.60	18 - 93.60
Teamsters	4.80	2 - 9.60	3 - 14.40
Swampers	4.80	4 - 19.20	0 - 0.00
Deckers	4.80	2 - 9.60	0 - 0.00
Sawyers	4.80	4 - 19.20	0 - 0.00
		32 - \$159.92	33 - \$167.92

The wages of Cook, Second Cook, and Flunkey are not charged against the camp cost, as the deductions from the wages of labor will cover the cost of subsistence and kitchen labor.

#10. - Work stock - Work horses are required in connection with whitebark pine work for the skidding of the infested logs into decks for subsequent burning. In this connection single skid horses can be used more efficiently than teams. In lodgepole pine camps, pack stock is required to transport the oil and treating equipment behind the combination spotting and treating crews:

	Whitebark Pine Camps	Lodgepole Pine Camps
Skidding horses	2 - \$2.50	
Pack horses		6 - \$7.50
Saddle horses		3 - 3.75
	\$2.50	\$11.25

#11. - General overhead - This set-up does not include a general supervising officer for each forest, as it is assumed that such positions would be held by local officers. It does include such supervision and administrative personnel as is believed necessary:

Unit Manager (charge of 25-35 camps) @ \$14.25 per day	
Subunit Manager (charge of 5-8 camps) @ 12.48 " "	
Purchasing & Fiscal Agent for each Forest @ 14.52 per day	
Clerks (3)	6.40 " "
Warehouseman (1)	9.60 " "
Assistant Warehousemen (6)	6.40 " "

These charges have been computed for the different forest projects and the total number of camps for the entire project, to which this cost has been prorated, giving a charge against each camp of \$3.34.

RECAPITULATION OF PERSONNEL AND WORK STOCK REQUIRED

<u>Position</u>	<u>Number Required</u>
Unit Managers	14
Purchasing and Fiscal Agents	4
Subunit Managers	70
Work Foremen	418
Warehousemen	4
Cooks	488
Packers	210
Checkers	418
Chief Spotters	1,131
Second Cooks	418
Assistant Warehousemen	24
Clerks	82
Truck Drivers	38
Flunkies	418
Treaters (spotters, compassmen, teamsters, deckers, sawyers, swampers, straw bosses)	10,032
	13,769
Pack stock	1,890
Work stock	2,541
	4,431

CONCLUSIONS AND RECOMMENDATIONS

In attempting to summarize this situation for the purpose of drawing a final conclusion, I recognize that there are distinct lines of responsibility resting upon the different federal bureaus involved. In recommending the institution of insect control upon public lands, the function of this bureau is to advise as to the need for control and the benefits which will be derived from it. The economics of such projects, especially where large expenditures are involved, rightfully rests upon the land-managing bureaus concerned. However, as the entomological and economic phases of such projects are more or less interwoven, it is extremely difficult to render a decision upon one without due consideration of the other. Therefore, I have taken the liberty of commenting upon the economic and physical phases of this project as well as those of an entomological nature.

Though control has been deemed necessary for all of the areas listed in this report, there are only a few where the timber values at stake would actually justify the expense of the operation. On the remaining areas--and with this project they are decidedly in the majority--the values are very low, but on these areas the existing infestation must be controlled in order to prevent the reinfestation of more valuable units adjacent. This fact raises the cost of the operation far above what will undoubtedly be the value of the commercial timber involved.

Scenic forests are more difficult to evaluate, though it is recognized that they often outweigh those of a commercial nature. It is true that this project has as its greatest objective the preservation of scenic forests; however, I do not believe that the values would justify the required expenditure over a three- or four-year period.

In contemplating the institution of this project there are problems of a physical nature which must receive full consideration. I consider spring control projects to be emergency operations, because the period during which such work can be conducted is limited. The start of spring projects is governed by weather and snow conditions on the ground, while the end is coincident with the development and emergence of the beetles. The fact that this project must be instituted and completed in the very short period of eight or nine weeks or perhaps less, depending upon the season, has a direct bearing upon other phases such as labor, etc. The task of gathering thirteen thousand woodsmen into this small area for such a short period of time presents innumerable difficulties. This project would be conducted at a season of the year when work in connection with regular forest activities is available, which is more attractive to the trained woodsmen because of its longer duration. This fact would be a handicap to securing the proper personnel organization. The question of securing sufficient pack stock would be an expensive and difficult problem, as it is obvious that the local supply would not be sufficient.

After due and careful consideration of all factors appertaining to this project, my reaction is that the thoughts of reopening this project in the spring of 1934 are economically, physically, and perhaps entomologically unsound. Therefore, it is recommended that further consideration of the Yellowstone Park bark-beetle control project be discontinued, though a final decision on this matter must rest with the agencies charged with the protection of the timber lands. The seriousness of this recommendation is appreciated, and I realize that my judgment may be in error, but I sincerely feel that I would be unmindful of my duty if I failed to frankly state my personal reaction to this project.

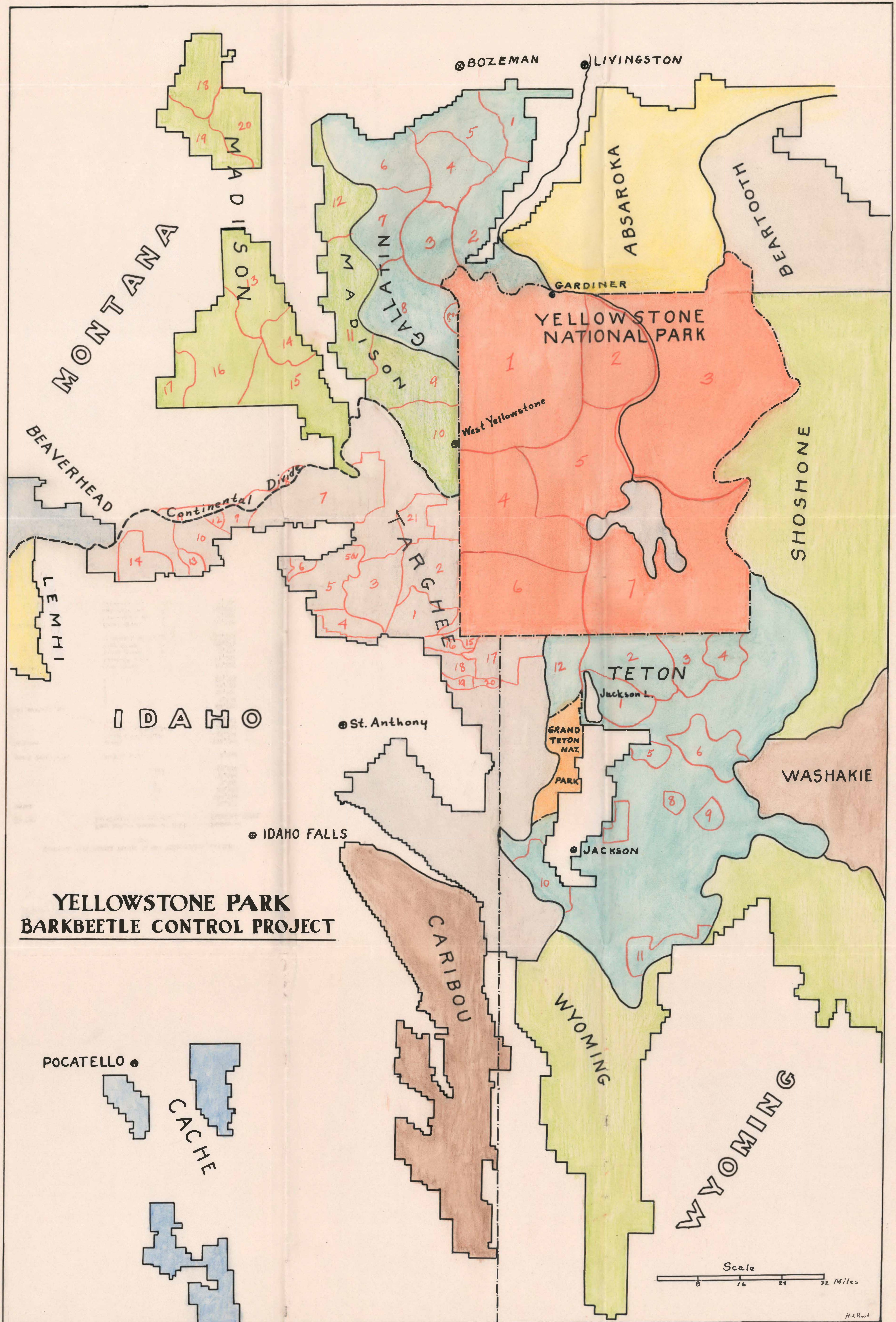
Respectfully submitted

James C. Evenden
Entomologist

MOUNTAIN PINE BEETLE STATUS ON THE YELLOWSTONE PROJECT
1934

<u>Forest</u>	<u>Name and/or Number of Unit Considered for Control</u>	<u>Number of Infested Trees</u>
Teton	1	21,077
	2	144,108
	3A	22,545
	8	3,464
	10	11,000
	12	53,800
Grand Teton Park	Entire Park	4,000
Targhee	1-2-3	180,500
	15-16-17-18-19-20	59,830
	7-8-9-10-11-12-13-14	88,300
	4-5-5A-6	184,523
Yellowstone Park	1	67,536
	2	4,422
	3	20,000
	6	84,690
	7	38,583
Madison	Jack Creek 12	32,225
	Crockett Lake 13	80,080
	Horse Creek 14	9,293
	Ruby River 16	95,975
	Blacktail Hills 17	37,713
Gallatin	Miner Creek 2	37,000
	Swan-Squaw Cr. 4	9,590
	Gallatin Pk. 6	21,000
	Monument Cr. 8(a)	3,150

**YELLOWSTONE PARK
BARKBEETLE CONTROL PROJECT**



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